

WHAT IS CLAIMED IS:

1. A liquid discharge head comprising:
 - a discharge energy generating element for generating energy for discharging a liquid droplet;
 - 5 an element substrate having a main surface on which said discharge energy generating element is provided;
 - a discharge port portion having a discharge port for discharging the liquid droplet;
 - 10 a nozzle having a bubbling chamber in which a bubble is generated in liquid by said discharge energy generating element and a supply path for supplying the liquid to said bubbling chamber;
 - a supply chamber for supplying the liquid to
 - 15 said nozzle; and
 - an orifice substrate joined to the main surface of said element substrate;
- wherein
- said bubbling chamber includes a first bubbling
 - 20 chamber which is communicated with said supply path and uses the main surface of said element substrate as a bottom surface thereof and in which the bubble is generated in the liquid by said discharge energy generating element and a second bubbling chamber
 - 25 communicated with said first bubbling chamber,
 - said second bubbling chamber is communicated with said discharge port portion,

a central axis of a lower surface of said second bubbling chamber coincides with a center axial of an upper surface of said second bubbling chamber in a direction perpendicular to said substrate,

5 a sectional area of the upper surface with respect to the central axis of said second bubbling chamber is smaller than a sectional area of the lower surface with respect to the central axis of said second bubbling chamber,

10 the sectional area in the central axial direction is changed continuously from the lower surface to the upper surface of said second bubbling chamber, and

 the sectional area of the upper surface with
15 respect to the center axis of said second bubbling chamber is greater than a sectional area with respect to a central axis of said discharge port portion.

2. A liquid discharge head according to claim 1,
20 wherein, regarding a side wall surface of said second bubbling chamber, a sectional area thereof in the central axis direction is changed continuously from the lower surface to the upper surface of said second bubbling chamber with inclination of 10 to 45 degrees
25 with respect to a plane perpendicular to the main surface of said element substrate.

3. A liquid discharge head according to claim 1,
wherein said first bubbling chamber is enclosed, in
three directions, by nozzle walls for partitioning
said plural nozzles arranged in parallel to
5 individual nozzles and,

a wall surface of said discharge port portion
is parallel with the plane perpendicular to the main
surface of said element substrate.

10 4. A liquid discharge head according to claim 1,
wherein said first bubbling chamber is enclosed, in
three directions, by nozzle walls for partitioning
said plural nozzles arranged in parallel to
individual nozzles and,

15 a wall surface of said discharge port portion
has taper smaller than 10° with respect to the plane
perpendicular to the main surface of said element
substrate.

20 5. A liquid discharge head according to claim 1,
wherein an upper surface of said supply path parallel
with the main surface of said element substrate near
said supply chamber is higher than an upper surface
of said supply path contiguous to and flush with an
25 upper surface of said first bubbling chamber and is
connected to the latter upper surface via a stepped
portion, and

a maximum height of said supply path from the surface of said element substrate is smaller than a height from the surface of said element substrate to the upper surface of said second bubbling chamber.

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6. A liquid discharge head according to claim 1, wherein a width of said supply path on a plane perpendicular to a flowing direction of the liquid is changed along a thickness direction of said orifice substrate in the vicinity of said stepped portion.

7. A liquid discharge head according to claim 1, wherein said nozzle is designed so that a sectional area of the flow path extending from said discharge port to said supply chamber is changed with plural stages.

8. A liquid discharge head according to claim 1, wherein said nozzle is formed so that a discharging direction along which the liquid droplet is flying from said discharge port becomes perpendicular to a flowing direction of the liquid flowing in said supply path.

25 9. A liquid discharge head according to claim 1, wherein said nozzle is formed so that the sum of volumes of said first bubbling chamber, said second

bubbling chamber and said discharge port portion becomes smaller than a volume of said supply path.

10. A liquid discharge head according to claim
5 1, wherein the bubble generated by said discharge energy generating element is communicated with atmosphere during the discharging.

11. A liquid discharge head according to claim
10 1, wherein said orifice substrate is provided with plural nozzles corresponding to the respective discharge energy generating elements and said plural nozzles are divided into a first nozzle array in which said nozzles are arranged so that longitudinal
15 directions of said nozzles becomes in parallel and a second nozzle array which is disposed at a position opposed to said first nozzle array with the interposition of said supply chamber and in which the longitudinal directions of said nozzles becomes in
20 parallel, and

longitudinal central axes of said nozzles in said second nozzle array are disposed with respect to longitudinal central axes of said nozzles in said first nozzle array by $1/2$ of a pitch between the
25 adjacent nozzles.

12. A method for manufacturing a liquid

discharge head comprising a discharge energy
generating element for generating energy for
discharging a liquid droplet, an element substrate
having a main surface on which said discharge energy
5 generating element is provided, a discharge port
portion having a discharge port for discharging the
liquid droplet, a nozzle having a bubbling chamber in
which a bubble is generated in liquid by said
discharge energy generating element and a supply path
10 for supplying the liquid to said bubbling chamber, a
supply chamber for supplying the liquid to said
nozzle and an orifice substrate joined to the main
surface of said element substrate, the method
comprising the steps of:

15 coating thermal bridge type organic resin
soluble by solvent and adapted to form a pattern for
said first bubbling chamber and a lower portion of
said supply path on said element substrate having the
main surface on which said discharge energy
20 generating element is provided and heating the resin
to form a thermal bridge film;

coating organic resin soluble by solvent and
adapted to form a pattern for said second bubbling
chamber and an upper portion of said supply path on
25 said thermal bridge film;

exposing and developing the organic resin by
using Near-UV light having a wavelength of 260 to 330

nm in order to form the pattern for said second
bubbling chamber and the upper portion of said supply
path;

forming inclination of 10 to 45 degrees by
5 heating the exposed, developed and pattern-formed
organic resin at a temperature smaller than a glass
transition point;

exposing and developing said thermal bridge
film by using Deep-UV light having a wavelength of
10 210 to 330 nm;

laminating said orifice substrate having a
discharge port by coating, exposing, developing and
heating negative type organic resin on a flow path
pattern formed by the two-layer soluble films; and

15 forming said discharge port portion for
discharging the liquid droplet, said nozzle having
said bubbling chamber in which the bubble is
generated in liquid by said discharge energy
generating element and said supply path for supplying
20 the liquid to said bubbling chamber, said supply
chamber for supplying the liquid to said nozzle and
said orifice substrate joined to the main surface of
said element substrate, by illuminating Deep-UV light
onto said two-layer flow path forming organic resins
25 formed on said lower layer via said orifice substrate
thereby to remove the resins by solvent.

13. A method according to claim 12, wherein, said second bubbling chamber and the upper portion of said supply path are formed by pattern transferring, by using a photo-mask in which a pattern of said
5 second bubbling chamber is a normal resolving power pattern of the organic resin and a pattern of the upper portion of said supply path is a pattern smaller than limited resolving power of the organic resin and by using Near-UV light having a wavelength
10 of 260 to 330 nm.

14. A method according to claim 12, wherein the formation of said second bubbling chamber and the upper portion of said supply path is divided into an
15 area where the resin is removed completely, an area where the resin is removed partially and an area where the resin is not removed at all in said exposing and developing step of the organic resin.

20 15. A method according to claim 14, wherein, in said exposing and developing step of the organic resin, said area where the resin is not removed at all forms said second bubbling chamber and said area where the resin is removed partially forms the upper
25 portion of said supply path.

16. A method according to claim 12, wherein a

height of said first bubbling chamber on said element
substrate is 5 to 20 μm and is formed with
inclination of 0 to 10° with respect to a plane
perpendicular to the main surface of said element
5 substrate.

17. A method according to claim 12, wherein the
thermal bridge type organic resin for forming said
first bubbling chamber and said supply path mainly
10 includes methyl methacrylate and is formed by
dissolving material obtained by being copolymerized
with methacrylic acid and methacrylic acid ester into
coating solvent.